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THE SCIENTIFIC WORKS OF SIR WILLIAM SIEMENS.

The Scientific Works of Sir William Siemens, LL.D., D.C.L., F.R.S. 3 Vols. (London: John Murray, 1889.)

THE "Life of Sir William Siemens," which was noticed in the pages of NATURE some months ago, has been followed by three most interesting volumes containing a reprint of his scientific papers. The task of editing the collection was committed by the executors to Mr. E. F. Bamber, for many years private secretary to Sir William Siemens, and it has been admirably discharged. The labour has been no light one; for the volumes contain, besides the greater and more highly finished contributions to the learned Societies, a very large number of extracts from the published proceedings of the various Societies and from the scientific journals—reports of the speeches delivered by Sir William Siemens during the discussions at scientific meetings.

Many of these papers are of high scientific importance, particularly to various classes of engineers, electricians, and chemists; and the whole collection forms a monument of unusual interest, exhibiting the many-sided nature of Siemens' labours and inventions. Both the papers and the unwritten speeches are very remarkable for clearness of thought and of style. Siemens was pre-eminently a man who made up his mind with complete decision, after careful thought, on whatever came before him. This decisiveness gave him the power of taking hold of a matter by the right end in the exposition of it: and the consequence is a clearness of thought and of diction which are alike unusual and satisfactory. The reader seldom requires, even in the case of descriptions of complicated apparatus, to reperuse a sentence; nor is it ever difficult to follow the reasoning on which an opinion is based.

Of the three volumes before us, the first contains the contributions of Siemens to the subjects of heat and metallurgy. The second is mainly taken up with electricity and miscellaneous subjects; while the many lectures and addresses, which from time to time he was called upon to deliver, are collected in the third volume.

It is impossible, in a brief article like the present, to review in detail these substantial volumes, or offer any lengthened criticism of their contents. We must content ourselves with such brief notice of them as will indicate to our readers some of the chief features in the life-work of this remarkable man.

In the second volume, under the heading "Miscellaneous Subjects," will be found two papers of no great length, but of special interest. These papers contain an account of Siemens' improved water-meter. Of what vast importance this invention proved to the inventor is probably not generally known. To use a common expression in the widest sense, "it made his fortune." It was his first thoroughly successful invention; and it gave to the young engineer the pecuniary assistance (greatly needed at the time) which enabled him to push forward into higher and yet higher regions of invention and success. The meter was invented in 1850–51, and patented in 1852. It satisfied the tests of a committee of inquiry of the Manchester Corporation Waterworks; and very soon a large number of the meters were at work, and were giving complete satisfaction. The general principle is that of using "various arrangements of screws or helices, which are caused to revolve by the passage of water or other fluid through them, and of fixed guides and channels in connection with such screws or helices to regulate and direct the current of the fluid, together with various contrivances for registering the number of revolutions of the screws." For the larger meters a many-bladed screw is used, the blades and guides being properly shaped that the blades may "partake fully of the onward motion of the water without sensibly impeding or agitating the same." For the smaller meters a kind of Barker's mill is used, with conditions as to the inlet and outlet arranged to fulfi the object in view.

"From a practical point of view," says Mr. Pole, in his "Life of Siemens," "the Siemens water-meter has been one of the most useful and valuable machines ever brought into hydraulic engineering. . . . . Down to the end of 1885 nearly 130,000 meters had been sold by Messrs. Guest and Chrimes (the first makers) alone, and in many cases it has been established as the standard apparatus for the sale of water." The two papers contained in the present volume were contributed in 1854 and 1856 to the Institution of Mechanical Engineers, and they contain a full discussion of the conditions necessary to be fulfilled by a water-meter, and descriptions, with illustrative drawings, of the inventions in this direction of the author.

In the first volume are contained the papers of Siemens on heat and metallurgy. These are well known to all workers in these departments of science and industry, and a brief notice must suffice here, in spite of their vast intrinsic importance. Very early in his life we find Siemens devoting his attention to the "regenerative principle" in heat. The words "regenerator" and "regenerative" are most unfortunate—utterly misleading to those who attempt to imagine the nature of the "principle" from the name by which it is called. The names, however, were not due to Siemens, but to Dr. Stirling, inventor of the hot-air engine; and it is worthy of being mentioned here that Siemens objected to the name, and wrote to Mr. Manby, a friend of Dr. Stirling, that "perceiving him (Stirling) to repudiate the name of 'respirator,' I really think he would confer a benefit on posterity if he would give his child a proper name, that of 'regenerator' being certainly incorrect, and likely to produce misconception."

The name "respirator" readily suggests the nature of the principle here spoken of. The metallic plate of a respirator, used by delicate people to protect the lungs or throat, takes up the heat of the outgoing breath and parts with it again to the air which is inspired; and this is precisely the principle of the heat-saving arrangements with which the name of Siemens is so closely connected. It may be, however, that a better name than either of these could easily be found.

In this first volume of the papers we find the titles of many communications describing arrangements for heat-saving and for obtaining increased temperatures by causing what would otherwise be waste heat to warm the air or gaseous fuel used in the process of combustion. Thus we have a "regenerative condenser for high-pressure and low-pressure steam-engines"; a "regenerative steam-engine"; the regenerative furnace applied to glass houses and to various metallurgical processes—to the manufacture of steel, the puddling of iron, &c.

Towards the close of his life, Siemens took up warmly the question of abatement of smoke in large towns, and economy in domestic heating and lighting. Accordingly we find interesting and important papers on the use of coal-gas as a fuel, and on gas supply both for heating and illuminating purposes. These papers contain a description of a regenerative domestic fire and a regenerative gas-lamp. It is very surprising that the views of Siemens on these important subjects have been so little appreciated by the gas companies on the one hand, and by the general public on the other. The smoke nuisance becomes year by year more and more terrible in our large towns; while the gas companies are undoubtedly neglecting to take advantage of sources of enormously increased profits to themselves.

Space fails us to enter into any detailed account of the important papers on metallurgy contained in the second part of the volume just now before us. In these are elaborated the descriptions of his improvements in iron processes. The two main features of the inventions are, first, the production of "mild steel," as it is called, of a quality surpassing that obtained by older processes; and, second, the production of first-class steel by the "direct process"—that is, directly from the ore instead of from the pig-iron of the blast-furnace, or from puddled iron. It is probable that even now, when there are over a million tons of steel being produced annually in Great Britain alone by the processes of Siemens, we are far from seeing in full the results of these improvements. It must be remarked, however, with regard to the direct process that the very existence of the enormous establishment of blast-furnaces in this and other countries constitutes a formidable adversary to its introduction.

The volume containing the papers of Siemens on electrical subjects is naturally divided into two parts: one containing papers on cable-laying, &c., and the other on the production of electricity by the dynamo-electric machine, and its application when so produced. The life of Siemens was intimately associated with the electrical developments which have made the last forty years startling in the rapidity of growth and improvement. By the electric telegraph, the commercial and social relations not only of individuals, but of the nations, have been revolutionized; while with regard to the dynamo-electric machine, much as its invention has accomplished, there can be no doubt but that its past and present are but infinitesimal compared with its future importance. The papers of Siemens must always have exceptional interest in connection with the early history of these two industries.

We cannot do more here than mention a few of them. First we have three papers largely taken up with land-line telegraphs, and giving an account of the progress which Dr. Werner Siemens was making in Germany, both in the construction of telegraph lines and in the improvement of telegraph instruments. Next we meet with a paper describing a machine for covering telegraph wires with india-rubber. Then we have contributions to the tests of deep-sea cables; and again, a paper on the outer covering of deep-sea cables. A most interesting paper gives an account of the steamship *Faraday* and her appliances for cable-laying. The *Faraday* was built with the object of laying the Direct United States cable, and was fitted with every appliance which the experience of former great submarine cables had suggested as important. A number of minor papers give descriptions of accessory instruments and appliances connected with the work of laying down deep-sea cables. Thus we have a deep-sea thermometer, the bathometer, &c., described in short interesting memoirs.

The papers connected with the production of electricity by the dynamo-electric machine, and of the uses of the great currents so produced, deal with a department of science and industry in which Sir William Siemens and his brothers were pioneers. The Siemens family, and the manufacturing firms of Siemens in this country and in Germany, designed and produced machines which undoubtedly were the best of those early days, and which served Siemens in setting on foot the first electric railways, the first electric furnaces, and first and only experiments on horticulture by electric light.

Only a few lines remain to us in which to refer to the third of these volumes. A man of Siemens's power and standing, and one who was able to speak with authority on so many subjects of high scientific and commercial interest, was naturally called on to give many more or less popular expositions of these subjects. Many lectures and addresses were therefore obtained on various occasions from this gifted and public-spirited man. These are collected in the third volume of the papers. Here we find addresses on deep-sea telegraphs, testing electric cables; on fuel, a popular lecture to the working classes under the auspices of the British Association at Bradford; on air-engines and steam-engines, in which the regenerative principle is explained; on utilization of heat, a lecture under the Glasgow Science Lectures Association; on waste, delivered to the Coventry Science Classes; several addresses and speeches on subjects connected with the production and uses of steel. We have also addresses which he delivered as President of various learned Societies—as President of the Mechanical Section of the British Association; two addresses to the Society of Telegraph Engineers, two to the Iron and Steel Institute, his address as President of the British Association in 1882, and many other minor addresses and speeches.

Among other subjects on which Siemens had thought deeply, is the highly important one of technical education, which is exercising the minds of so many at the present time. He had more than common opportunities for forming a correct judgment on the requirements of those who are to advance the various arts and industries of the world; and his knowledge of Germany and England, and of German workmen and English workmen in very varied departments, gave him special title to speak with authority on this subject. The consequence is that in many of his shorter addresses and speeches very valuable remarks and criticisms are to be found on this question so vital to our national prosperity.

In taking leave of these important volumes, we cannot but feel that scant justice has been done to them in this brief article. It is only a very small proportion of the subjects on which Siemens thought and wrote to which we have been able even to allude. Very many subjects occupied his active mind, and it is most remarkable how thoroughly and completely each one of them was worked out and brought down to a definite conclusion. Much he attempted; and pre-eminently he acted on the principle that "whatever is worth doing is worth doing well."

THE ADVANCEMENT OF MEDICINE.

Reports from the Laboratory of the Royal College of Physicians, Edinburgh. Edited by J. Batty Tuke, M.D., and G. Sims Woodhead, M.D. Vol. I. (Edinburgh and London: Young J. Pentland, 1889.)

IT is a healthy and most welcome sign of the increased interest taken in pathological research that, at the conclusion of what is but the first year of its existence, the laboratory instituted by the Royal College of Physicians of Edinburgh has been able to issue a volume of Reports of such importance as the one lying before us. When, further, it is noted that this is, if we mistake not, the first volume of its kind published in the United Kingdom—the first collection of papers emanating from a single laboratory, and treating of pathology alone—then the energy that is being displayed north of the Tweed in the advancement of medicine by research should gain the cordial appreciation it well deserves.

Willing as our own Royal Colleges of Medicine have of late shown themselves to encourage investigation, they have, from a variety of causes, been unable to bring forward their schemes to a practical issue with the rapidity and thoroughness displayed by their Edinburgh *confrère*, and although the idea of instituting a research laboratory has for long engaged the attention of the authorities in Lincoln's Inn Fields, we are still very far from seeing that laboratory in complete working order.

It must be admitted that, to devise the details of a new departure such as this is far from being an easy task. Many and opposing interests have to be taken into account, and, as may be gathered from Dr. Sims Woodhead's introductory article, at Edinburgh, despite the ardour of Dr. Batty Tuke and his Committee, nearly two years elapsed before plans could be developed to the stage at which they were at the same time feasible and acceptable to the College of Physicians. But, this stage once passed, no time was lost. A commodious house was taken and adapted to the required purposes, a scientific superintendent appointed in the person of Dr. Woodhead, and in the course of a very few weeks the laboratory was ready.

The regulations laid down by the College are conceived upon a broad and generous basis. The laboratory is open without fee to Fellows and Members of the College, and, with the sanction of the Committee and Curator (Dr. Batty Tuke), to any Licentiate, and "to any medical man or investigator who shall obtain the sanction of the Council of the College, as well as of the Curator and Committee, to use the laboratory for the purposes of scientific research." The scientific superintendent, while himself undertaking the prosecution of original research, shall be prepared to assist, if required so to do, in the work of the investigators, and it would appear that leave having once been given to work in the laboratory, little or no restriction is placed upon the investigators with regard to the nature of their work beyond the broad control exercised by the superintendent. All these points are worthy of attention at the present time when a similar institution is in the process of development in London. This volume, coupled with the fact that during the first year two-and-twenty investigators in one or other department of medicine have made use of the laboratory, yields full evidence of the success of the scheme.

We note with some curiosity what is apparently an effort to reconcile opposing views as to the functions of the new laboratory, in the regulation requiring the superintendent to furnish the Fellows of the College "with reports. . . upon the histology of morbid specimens and of the chemical and microscopic characters of urines." Certainly, by undertaking work of this kind the laboratory becomes of very definite service to the Fellows, and could our English Colleges, for example, see their way to the institution of departments to which members might send any morbid material as to whose nature they desired advice, they would, by adding largely to the possibilities of a correct diagnosis, confer no little benefit upon the public, apart from the benefit they would bestow upon their members. It is, however, questionable whether this form of work falls within the province of medical corporations; it is still more questionable whether such work can wisely be required of one whose time and energies, as director of a research laboratory, are liable to be wholly utilized in a very different direction.

Coming now to the consideration of the papers which form the volume before us, we may say that they well exemplify the tendencies and traditions of the Edinburgh medical school. Bacteriology is represented by the details of an investigation into the air of coal-mines; by Dr. Woodhead's very able "Notes upon the Use of Mercuric Salts in Solution as Antiseptic Lotions"; by the report of an inquiry undertaken in Japan as to the causation of cholera, the work of Dr. N. Macleod and Mr. W. J. Miller (tending to confirm Koch's views); and also by the condensed report of Dr. Woodhead's lectures before the Grocers' Company upon tabes mesenterica and pulmonary tuberculosis. This last, and Dr. Bruce's article upon a case of absence of the corpus callosum in the human brain, are both of very general scientific interest, and represent the accurate and thoughtful work done at Edinburgh in the domain of pathological histology; while the large proportion of four papers out of the eleven of which the volume is composed, reflects the prominent position long held by Edinburgh in the department of gynæcology.

With scarce an exception, the reports bear upon practical matters, and have more than an academic value. But at the same time they exhibit the one especial weakness of the school. Pathology, embracing as it does the whole of medicine save the treatment of disease, is capable of being advanced by two equally valuable methods, the synthetic and the analytic, as they may be termed: on the one hand by studying the part played by individual